

8.4 Minerals and Mining

South Africa has an abundance of mineral resources and as a result is a world leader in mining, contributing significantly to the world's primary mineral production and reserves.

However, as South Africa's secondary and tertiary industries have grown, the direct contribution of mining to South Africa's Gross Domestic Product (GDP) has declined, from more than 20% in the 1970s, to its current level of around 9%.¹ Nevertheless, the mining industry is still the second largest employer in South Africa (after agriculture), and if the indirect multiplier and induced effects of mining are included, then the sector's overall contribution to South Africa's GDP is closer to 18%.²

KZN's contribution to the South African mining sector is relatively small, averaging about 1.9% of the total mineral export sales and around 5.4% of local sales over the last 20 years.³ Mining only contributes about 2.3% to the province's

total GDP.⁴ Although it has not been blessed with the mineral riches of some of the other South African provinces, KZN is a world leader in terms of titanium mineral concentrates production.

Titanium

South Africa is the second largest producer of titanium feedstock in the world, contributing 17%, after Australia (20%).⁵ South Africa produced 1.03 million tons of titanium dioxide (TiO₂) from ilmenite ore and 131 000 tons from rutile ore in 2012.⁵ More than 75% of South Africa's total titanium production is mined in KZN, from two heavy metal sand mining operations located in the coastal zone. The rest is produced at a third mine located near the Olifants River in the Western Cape (Tronox Namaqua Sands). The KZN mines employ about 2 500 local people directly, and an equivalent number through contracts.

Dredge mining of dunes, near Richards Bay.



Photo: ORI

Because of their durability, density and chemical stability, heavy minerals such as ilmenite, rutile and zircon withstand the weathering of igneous and metamorphic rock, and are transported from the interior of the continent by rivers, eventually reaching the sea. Over geological time, wave action deposits the sea sand containing the heavy minerals back onto the beaches. Ilmenite and rutile are two of the minerals found in heavy metal sand deposits from which titanium can be extracted.

The largest heavy mineral sand mining operator in KZN is Richards Bay Minerals (RBM). In fact, the company is the largest titanium slag producer in the world, with an annual production of about one million tons, and mining reserves estimated to last 15-20 years.⁶ This Rio Tinto-controlled company has mined the dunes along the northern KZN coast since 1977, extracting heavy mineral concentrate from the sand dunes at four mining plants, split between two lease areas north of Richards Bay; a 17 km x 2 km strip at Tisand, and a 20 km x 2 km strip at Zulti North.

A dredge mining technique is used to extract ilmenite, rutile and zircon from the sand,⁷ whereby the coastal dunes are stripped of vegetation, and a large, shallow pond is excavated and filled with water. A dredger and concentrating plant are then floated on the pond. One side of the pond is destabilised by the dredger and the sand slumps into the water, the resulting slurry is sucked up by the dredger and pumped through the concentrating plant, where the heavy metals are separated from the sand. The dredger moves forward as the pond wall slumps; at the same time the discarded sand from the concentrating plant is piled behind the unit, resulting in a self-perpetuating pond, moving forward across the sand dunes at a rate of about 2-3 m per day.⁸ The heavy metal concentrate is then transported to a smelting plant where the material is further processed and smelted, to produce titanium slag.

Another company, Tronox KZN Sands, has been mining heavy mineral sands at its Hillendale mine since 2004, 20 km south-west of Richards Bay. Hydraulic mining is used, whereby a high pressure water jet is directed onto the dune face to undermine it, causing it to collapse. The water is used to break up the disaggregated sand into slurry, which is pumped to a primary wet plant (PWP) at the mine. The concentrate is then transported to a central plant for further processing. The smelters at this plant have the capacity to produce 250 000 tons of titanium slag per year. However, the Hillendale mine is reaching the end of its lifespan, and the company has

announced their intention to construct a new mine at Fairbreeze, near Mtunzini. A lease area of 4 143 ha has been secured, of which about 1 410 ha will be mined.⁹ The same hydraulic mining technique will be used, with the aim of processing 2 200 tons of sand per hour. The mine is expected to start production in 2014, but is experiencing opposition from conservation organisations and the Mtunzini community.

Offshore mining

More recently, there has been increased interest in offshore prospecting and mining, particularly for sections off the KZN coast. In 2004, RBM were issued a five-year heavy metals prospecting permit by the Department of Minerals and Energy in order to prospect along the northern KZN coast, between Richards Bay and Cape St Lucia.¹⁰ The company was surveying in order to determine the viability of offshore mining for ilmenite, rutile and zircon on the continental shelf.¹⁰

It is anticipated that should RBM determine that mining for these heavy minerals is feasible and economically viable, they will apply for a mining permit. If granted, they will implement a dredge-type mining system, similar to that used by offshore diamond mining activities.¹⁰

More recently there have been prospecting activities in the area offshore from the Thukela River Mouth (the Thukela Banks). Mining and prospecting in this area is of concern as the site is a valuable prawn and fish nursery. Impacts pertaining to offshore mining are largely unknown and likely to have an adverse effect on the marine ecology of the entire North Coast of KZN.

Oil

While oil is not normally mined in KZN, there has been interest in an area of the Thukela Basin (which extends beyond the Thukela Banks), as there appears to be evidence that this area has untapped natural oil resources. A United States oil company has been legally embattled with the South African Agency for the Promotion of Petroleum Exploration (PASA) for the rights to explore this area for oil and natural gas.¹⁰ In November 2006 the case was dismissed and the scope for oil exploration in this region is now open to both local and international interests.¹⁰



Coal

South Africa was ranked 7th in the world for coal production in 2010, and has an estimated 3.5% of the world's coal reserves.¹¹ Although almost all of the coal exported from South Africa passes through KZN, mostly via the Richards Bay Coal Terminal, actual coal mining has decreased significantly in the province; from providing 40% of South Africa's coal production in 1900,¹² to about 1% at present (about 3 million tons per annum).

Carbonates

The Marble Delta is a geological feature situated close to the confluence of the Mzimkhulu and the Mzimkulwana rivers near Port Shepstone, an area of steeply incised valleys covering approximately 40 km². It is the only significant carbonate (i.e. marble, lime and limestone) deposit in KZN, and is made up of three formations: the Cherrywillingham Formation consists mainly of amphibolites and granulites; the Le Jonquet Formation is largely dolomitic; whilst the Oribi Formation is predominantly calcitic with dolomitic and graphitic layers. Historically, three large quarries were mined in this area, although the Department of Mineral Resources recorded only two active carbonate mining operations in KZN in 2012,¹³ both located within the Oribi Formation.

Natal Portland Cement (NPC), a subsidiary of Cimentos de Portugal (CIMPOR), mines the Simuma quarry, where about 2 million tons of limestone is mined per year.¹⁴ Three crushers reduce the limestone to less than 30 mm fragments, which are then transported to the Simuma factory, which currently operates two kilns that can produce about 140 tons of clinker (the precursor to cement) per hour at full production.¹⁵ NPC also has a cement factory in Durban, able to produce up to 1.2 million tons per year, and another in Newcastle, which produces about 450 000 tons of slagment per year. The company employs about 500 full time employees in KZN.

Idwala Carbonates mines about 1.2 million tons of calcitic and dolomitic limestone per year. They process the rock in two ways; the dry process is similar to the NPC operation, where two crushers break up the rock, which is then blended, screened and crushed further to a particle size of about 300 microns. In the wet process, the calcium carbonate is separated from the rest of the crushed fragments by two flotation banks, dried, classified and then milled into 0.8-15 micron particles, depending on the product required. The

high-grade material is used as filler in paint, paper, toothpaste, bread and plastic, whilst lower-grade material is used in rubber, glass and fibreglass. The company employs about 200 full time staff members, and a further 70 contract workers.

At the present rate of mining, the Marble Delta quarries have a life expectancy of over 100 years. Since the full extent of the formation is unknown due to the complexity of the geology, there is potential for locating new ore bodies in this area.

Dimension stone, aggregate and sand

Besides the large carbonate quarries, there are a number of other quarries of various sizes in KZN, some of which have been in existence for nearly a century. Some 100 active quarries were listed by the Department of Mineral Resources in 2012,⁶ mining a range of products: from dimension stone, aggregate stone and coarse sand for the construction and road building industry, to shale and clay used by brick makers such as Corobrik. Capstone 21, mining the Hays Quarry near Merrivale, and the Natal Granite Quarries, near Hammarsdale, are examples of companies mining and supplying dimension stone.

Stone aggregate is produced from numerous small quarries throughout the province for local use. The aggregates mined include granite chips, tillite, dolerite and sandstone. A rough estimate of the total annual aggregate production in KZN is about 4 million tons. Sand is also mined at a number of sites in KZN, but more worrying for the coastal region is sand mining from beaches and estuaries, inland dunes and dredged from ocean beds and river beds. Sand mining is discussed in detail in *Section 9.6*.

Other minerals

Other minerals that occur in deposits large enough to show economic potential in KZN include kaolin, lithium, dolomite, aluminium, chrome, vanadium, graphite and talc. Most of these have been investigated to some extent.

Minerals are an important resource for KZN and South Africa. However, mining activities, especially in the fragile coastal zone, need to be carefully managed in order to minimise adverse environmental effects. ■